CLAIMS:

1. A hydrogen storage composition comprising:

a catalyst composition disposed upon a storage composition; wherein the catalyst composition consists essentially of calcium, barium, titanium, chromium, manganese, iron, cobalt, copper, silicon, germanium, rhodium, rhodium, ruthenium, molybdenum, niobium, zirconium, yttrium, barium, lanthanum, hafnium, tungsten, rhenium, osmium, or iridium.

2. The composition of Claim 1, wherein the storage compositioncomprises carbon, oxides, aluminides, carbides, silicides, sulfides, nitrides, borides, oxides, oxynitrides, hydroxides, silicates, alanates, aluminosilicates, or a combination comprising at least one of the foregoing.

3. The composition of Claim 2, wherein the carbon comprises carbon black and/or carbon nanotubes.

4. The composition of Claim 2, wherein the oxides are metal oxides.

5. The composition of Claim 4, wherein the metal oxides are alumina, ceria, titanium dioxide, zirconium oxide, tungsten oxide (WO_3), nickel oxide (NiO_2), cobalt oxide (CoO_2), manganese oxides (Mn_2O_4 and MnO_2), vanadium oxides (VO_2 and V_2O_5), molybdenum oxide (MoO_2), or a combination comprising at least one of the foregoing oxides.

6. A hydrogen storage composition comprising:

a catalyst composition disposed upon a storage composition; wherein the catalyst composition comprises an alloy of calcium, barium, platinum, palladium, nickel, titanium, chromium, manganese, iron, cobalt, copper, silicon, germanium, rhodium, rhodium, ruthenium, molybdenum, niobium, zirconium, yttrium, barium, lanthanum, hafnium, tungsten, rhenium, osmium, iridium, or a combination comprising at least one of the foregoing metals.

7. The composition of Claim 6, wherein the alloy comprises platinum, palladium and/or nickel.

8. The composition of Claim 6, wherein the storage composition comprises carbon, oxides, aluminides, carbides, silicides, sulfides, nitrides, borides, oxides, oxynitrides, hydroxides, silicates, alanates, aluminosilicates, or a combination comprising at least one of the foregoing.

9. The composition of Claim 8, wherein the carbon comprises carbon black and/or carbon nanotubes.

10. The composition of Claim 8, wherein the oxides are metal oxides.

11. The composition of Claim 10, wherein the metal oxides are alumina, ceria, titanium dioxide, zirconium oxide, tungsten oxide (WO_3), nickel oxide (NiO_2), cobalt oxide (CoO_2), manganese oxides (Mn_2O_4 and MnO_2), vanadium oxides (VO_2 and V_2O_5), molybdenum oxide (MoO_2), or a combination comprising at least one of the foregoing oxides.

12. The composition of Claim 6, wherein the catalyst composition covers a surface area of about 1 to about 100% of the total surface area of the storage composition.

13. The composition of Claim 6, wherein the catalyst composition is disposed onto the surface of the storage composition as isolated particulates.

14. The composition of Claim 13, wherein the isolated particulates have a radius of gyration of about 1 to about 200 nanometers.

15. A method for storing hydrogen comprising:

immersing in a gaseous mixture comprising hydrogen, a hydrogen storage composition comprising a catalyst composition disposed upon a storage composition, wherein the catalyst composition consists essentially of calcium, barium, titanium, chromium, manganese, iron, cobalt, copper, silicon, germanium, rhodium, rhodium, ruthenium, molybdenum, niobium, zirconium, yttrium, barium, lanthanum, hafnium, tungsten, rhenium, osmium, or iridium;

dissociating the hydrogen into atomic hydrogen; and

storing the atomic hydrogen in the storage composition.

16. A method for storing hydrogen comprising:

immersing in a gaseous mixture comprising hydrogen, a hydrogen storage composition comprising a catalyst composition disposed upon a storage composition, wherein the catalyst composition comprises an alloy of calcium, platinum, palladium, nickel, barium, titanium, chromium, manganese, iron, cobalt, copper, silicon, germanium, rhodium, rhodium, ruthenium, molybdenum, niobium, zirconium, yttrium, barium, lanthanum, hafnium, tungsten, rhenium, osmium, or iridium;

dissociating the hydrogen into atomic hydrogen; and

storing the atomic hydrogen in the storage composition.

17. A method for generating hydrogen comprising:

heating a hydrogen storage composition comprising a catalyst composition disposed upon a storage composition, wherein the catalyst composition catalyst composition consists essentially of calcium, barium, titanium, chromium, manganese, iron, cobalt, copper, silicon, germanium, rhodium, rhodium, ruthenium, molybdenum, niobium, zirconium, yttrium, barium, lanthanum, hafnium, tungsten, rhenium, osmium, or iridium; or wherein the catalyst composition comprises an alloy of calcium, platinum, palladium, nickel, barium, titanium, chromium, manganese, iron, cobalt, copper, silicon, germanium, rhodium, rhodium, ruthenium, molybdenum, niobium, zirconium, yttrium, barium, lanthanum, hafnium, tungsten, rhenium, osmium, or iridium.

18. A method for the storage and recovery of hydrogen comprising:

contacting a hydrogen storage composition with a first gaseous mixture comprising a first concentration of hydrogen;

dissociating the hydrogen into atomic hydrogen;

storing the atomic hydrogen in the storage composition;

contacting the hydrogen storage composition with a second gaseous mixture comprising a second concentration of hydrogen; and

heating the hydrogen storage to a temperature effective to facilitate the desorption of hydrogen from the hydrogen storage composition.

19. The method of Claim 18, wherein the first concentration of hydrogen is greater than the second concentration.

20. The method of Claim 18, wherein the contacting a hydrogen storage composition in a gaseous mixture comprising a first concentration of hydrogen is conducted at a first location, and wherein the contacting the hydrogen storage composition in an environment comprising a second concentration of hydrogen is conducted at a second location.

21. The method of Claim 20, wherein the first location is not the same as the second location.

22. The method of Claim 20, wherein the first location is the same as the second location.

23. An energy generation device, wherein the composition of Claim 1 is used to generate energy.

24. An energy generation device, wherein the composition of Claim 6 is used to generate energy.

25. An energy generation device, wherein the method of Claim 17 is employed to generate energy.

26. An energy generation device, wherein the method of Claim 18 is employed to generate energy.